

the disintegration. It will be seen that in many cases the atomic weights of the various products can be deduced. In the succession of products produced by the disintegration of the uranium-radium series, there occur several rayless products and  $\beta$ -ray products. Assuming, as is not improbable, that the atomic products undergo an internal rearrangement without the expulsion of a mass comparable with the hydrogen atom, we can calculate the atomic weights of the successive products, taking the atomic weight of helium as 4. From the known range of the  $\alpha$  particles from uranium and the ionisation it produces compared with the radium associated with it, there is no doubt that uranium expels two  $\alpha$  particles to one from radium itself. Whether this is a peculiarity of uranium itself or due to an unseparated product in uranium is not settled.

Taking the atomic weight of uranium as 238·5, the atomic weights of the different products are as follows:—Uranium X 230·5, ionium 230·5, radium 226·5, emanation 222·5, radium A 218·5, radium B 218·5, radium C 214·5, radium D, E, and F (radio-lead) 210·5, radium A (polonium) 210·5. It will be seen that the calculated value of the atomic weight of radium is in good agreement with the most recent experimental values. The end product of radium after the transformation of polonium has an atomic weight of 206·5—a value close to that of lead (206·9). Boltwood long ago suggested, from examination of the amount of lead in old radio-active minerals, that lead was the probable final product of the disintegration of the uranium-radium series.

We cannot at the moment apply the same method of calculation to thorium products, for Bronson (*Phil. Mag.*, August, 1908) has recently brought strong evidence that the disintegration of the atoms of some of the products is accompanied by the expulsion of more than one  $\alpha$  particle.

In conclusion, it may be of interest to note that the experimental results recorded in this article lead to an experimental proof—if proof be needed—of the correctness of the atomic hypothesis with reference to the discrete structure of matter. The number of  $\alpha$  particles expelled from radium can be directly counted, and the corresponding volume of helium determined. In this way it is possible to determine directly the number of atoms in a cubic centimetre of helium quite independently of any measurements of the charge carried by the  $\alpha$  particles.

E. RUTHERFORD.

#### NOTES.

THE following is a list of the fellows recommended by the president and council of the Royal Society for election into the council for the year 1908-9:—*President*, Sir Archibald Geikie, K.C.B.; *treasurer*, Dr. Alfred Bray Kempe; *secretaries*, Prof. Joseph Larmor, Prof. John Rose Bradford; *foreign secretary*, Sir William Crookes; *other members of council*, Sir George Howard Darwin, K.C.B., Prof. J. C. Ewart, Sir David Gill, K.C.B., Dr. J. S. Haldane, Mr. C. T. Heycock, Prof. Horace Lamb, Prof. H. M. Macdonald, Dr. F. W. Mott, Hon. C. A. Parsons, C.B., Prof. W. H. Perkin, Prof. E. B. Poulton, Lieut-Colonel D. Prain, Sir Arthur W. Rücker, Right Hon. Sir James Stirling, Prof. F. T. Trouton, Mr. W. Whitaker.

THE Royal Society's medals have this year been adjudicated by the president and council as follows:—The Copley medal to Dr. Alfred Russel Wallace, in recognition of the great value of his numerous contributions to natural history, and of the part he took in working out the theory of the origin of species by natural selection; the Rumford

medal to Prof. H. A. Lorentz, for his investigations in optical and electrical science; a Royal medal to Prof. John Milne, for his preeminent services in the modern development of seismological science; a Royal medal to Dr. Henry Head, for his researches on the relations between the visceral and somatic nerves and on the functions of the afferent nerves; the Davy medal to Prof. W. A. Tilden, for his discoveries in chemistry, especially on the terpenes and on atomic heats; the Darwin medal to Prof. August Weismann, for his eminent services in support of the doctrine of evolution by means of natural selection; the Hughes medal to Prof. Eugen Goldstein, for his discoveries on the nature of electric discharge in rarefied gases.

M. PHILIPPE VAN TIEGHEM has been elected the permanent secretary of the Paris Academy of Sciences in succession to the late M. Becquerel.

THE International Congress of Geology will be held at Stockholm in 1910, when it is expected that Baron Gérard de Geer will, on his return from the Arctic regions, read a paper on polar geology.

A DEPUTATION from the Incorporated Society for the Destruction of Vermin waited upon Lord Carrington at the offices of the Board of Agriculture on October 29 to request the Government to appoint a commission to inquire into the damage to crops done by rats.

AN AGREEMENT has been signed by which England and Germany undertake to cooperate in combating the sleeping sickness in their East African possessions. The co-operation will take the form chiefly of exchanging reports of cases, and in arranging for the destruction of wild animals which act as "reservoirs," or provide nourishment, for the trypanosomes of sleeping sickness.

A COURSE of twelve lectures—the Swiney lectures on geology—on the geological history of the American fauna will be delivered by Dr. R. F. Scharff in the lecture theatre of the Victoria and Albert Museum, South Kensington, on Mondays, Wednesdays, and Fridays at 5 p.m. The first lecture was given on Monday last, November 2. Admission to the course is free.

WE learn through the *British Medical Journal* that Prof. Ehlers, of Copenhagen, well known as an authority on leprosy, is now in Paris with the view of organising a scientific expedition to the Danish West Indies, which comprise the islands of St. Thomas, St. John, and Santa Cruz. The object of the expedition is said to be to endeavour to determine the part played by blood-sucking insects, especially fleas and bugs, in the dissemination of leprosy.

THE Bisset Hawkins gold medal of the Royal College of Physicians has been awarded to Sir Shirley Murphy, medical officer of health of the County of London, for his distinguished services in the cause of public health. The FitzPatrick lectures of the college will be delivered on November 5 and 10 by Dr. Leonard Guthrie, on "The History of Neurology," and the Horace Dobell lecture by Mr. Leonard Dudgeon, on November 12, on "The Latent Persistence and the Reactivation of Pathogenic Bacteria in the Body."

ON October 30 Mr. Farman flew, with a machine heavier than air, seventeen miles across country in twenty minutes, from Châlons to a point just outside Rheims. The height of the course of flight was about 150 feet. On October 31 M. Blériot made flights across country from his station near Chartres, the longest being one of

nine miles in fourteen minutes. At Anvours on the same day Mr. Wilbur Wright made a flight of 10m. 37s. with a passenger. The new dirigible balloon, the *Clement-Bayard*, navigated by M. Henry Kapferer, on November 1 travelled a distance of about 200 kilometres, from Paris to Compiègne and back.

THE death is announced, at the age of forty-six, of Dr. F. A. C. Perrine, one of the leading American authorities on electrical engineering, and from 1893 to 1900 professor of that subject in the Leland Standford, Jr., University. He was afterwards consulting expert of the Standard Electric Company of California, which took the principal part in generating electrical energy at the mountain streams and transmitting it to the great cities of the Pacific coast. Of late years he was engaged in private practice as a consulting engineer. He was formerly editor of the San Francisco *Journal of Electricity* and of the *Chicago Electric Engineering*.

THE terms of reference have now been published of the Royal Commission appointed "to make an inventory of the Ancient and Historical Monuments and Constructions connected with or illustrative of the contemporary culture, civilisation, and conditions of life of the people in England, excluding Monmouthshire, from the earliest times to the year 1700, and to specify those which seem most worthy of preservation." The commissioners are authorised to call in the aid and cooperation of owners of ancient monuments, and are given full power to call before them such persons as are likely to afford any information upon the subject of the commission, and also to call for, have access to, and examine all such books, documents, registers, and records as may afford the fullest information on the subject. They are also empowered to visit and inspect personally such places as may be deemed expedient to inspect for the more effectual carrying out of the purposes of the inquiry.

A GENERAL meeting of the British Academy was held on October 28, when Dr. J. P. Postgate read a paper on flaws in modern classical research. In spite of the advances made and the results obtained in the field of classical research during the last sixty years, the outer world, he said, is still prone to doubt whether these are as great in proportion as those of other studies which claim to be scientific, or really commensurate to the time and energy expended upon them. The qualifications for any scientific research are competence and impartiality. Impartiality must be understood in a sense wide enough to include freedom from every prepossession which is likely to interfere with the proper weighing of the evidence. The first and generally neglected duty of the classical inquirer is the elimination of the personal equation. One of many disturbing elements found in every inquirer is the influence of modern forms of thought. The modern's comprehension of the facts is frequently impaired by the ethical judgments which he passes upon their character. A fertile source of error is the strength of modern vanity. We are the "heirs of all the ages," and the testimony of ancient witnesses is liable to be rejected summarily if either (a) we cannot reconcile it with what we deem we know otherwise, or (b) if it conflicts with evidence which we have had a hand in discovering. The procedure, especially in the less settled studies, such as archaeology and mythology, is often too lax. Impressions gathered in one field are carried over to another where they do not apply. Owing partly to the vastness of the regions to be investigated, the conclusions

of one band of inquirers are apt to be rejected by those in another sphere without proper consideration. In contrast to the true scientific spirit, which regards nothing as of no importance, inaccuracy in "minor" matters is condoned or even paraded, to the injury of fine scholarship and vivid appreciation of antiquity.

IN his presidential address to the Institution of Civil Engineers on November 3, Mr. J. C. Inglis dealt chiefly with engineering in relation to transport. In the course of his remarks he said it is only now dimly dawning in controlling quarters that there is a science of transport, and the fact that while British railways cost more than 50,000*l.* per mile, lines in Germany cost only about 20,000*l.*, in France 27,000*l.*, in America 11,000*l.*, and so on, is symptomatic only of the extent to which British legislation, when it is allowed to proceed on unsound lines, may prejudice vital interests. Mr. Inglis referred also to the work done by the institution in improving the status and efficiency of engineers. He holds that it ought to be laid down as a principle that all public money derived from rates and taxes should be, so far as it is applied in engineering constructions, expended under the direction or control of definitely qualified engineers, as is already the case in many countries. The establishment of such a principle would promote efficiency and economy in much public expenditure, and would immensely strengthen the profession, as well as benefit the State. The difference between British and German ideals was expressed recently by a German professor lecturing on economic subjects in words quoted by Mr. Inglis as follows:—"The aim of the German was everywhere to leave as little as possible to chance in the great struggle of the twentieth century, not to allow people to muddle through somehow, but to eliminate as far as possible the element of the unforeseen, while carefully training the mind to cope if necessary in an intelligent way with any emergency. While the British had, as a rule, a violent suspicion of the expert, and a strong belief in the untrained, unpaid amateur as the right source of wisdom, allowing the expert to advise and the amateur to decide, the German had no fear of the expert. He well saw the possible danger of red-tapeism at the hands of highly trained officials, but he found them less than the dangers arising from the decisions of well-meaning but untrained and inexperienced amateurs."

MR. A. R. BUTTERWORTH, chairman of the executive committee of the Highways Protection League, has issued a circular letter in which he gives statistics to show (1) the number of local authorities which desire to have the present speed-limit of motor traffic reduced, and to have power themselves to fix still lower limits of speed in towns and villages in their own districts without having to make application to the Local Government Board; (2) the great increase in the number of persons annually injured and killed by motor vehicles. It appears that in 1905 197 urban and rural district councils of England and Wales approved of a proposal to reduce the maximum speed-limit to fifteen miles an hour, and 212 desired to have power to fix lower limits of speed in towns and villages and at any places where they thought it desirable to do so in the public interest. Up to October 19, 102 applications have been made by local authorities to the Local Government Board to reduce the speed-limit on certain roads; of these, only twenty-two have been granted, while eighty have failed. With regard to accidents attributable to motor traffic, at the present moment there are no complete reports obtainable of such accidents occurring throughout the country generally, but

the subjoined table, compiled from figures annexed to the recent report of the Commissioner of Police, shows the increase in the Metropolitan Police District, which embraces an area of 700 square miles :—

*Accidents causing Death or Injury in the Streets within the Metropolitan Police District, 1897 to 1907 inclusive.*

|   | Deaths              |  |                      | Injuries  |   |   |
|---|---------------------|--|----------------------|---|---|---|
|   | Killed by<br>motors | Killed<br>by other<br>vehicles or<br>by horses | Injured by<br>motors | Injured by<br>other<br>vehicles or<br>by horses | Injured by<br>other<br>vehicles or<br>by horses | Injured by<br>other<br>vehicles or<br>by horses |
| Annual average for the five years 1897-1901 } | 1·4                 | ... 175  | 78                   | ... 9,338                                       |   |   |
| 1902  | 6                   | ... 169  | 319                  | ... 9,186                                       |   |   |
| 1903  | 6                   | ... 148  | 592                  | ... 9,610                                       |   |   |
| 1904  | 22                  | ... 133  | 1,112                | ... 9,272                                       |   |   |
| 1905  | 35                  | ... 137  | 1,557                | ... 10,131                                      |   |   |
| 1906  | 74                  | ... 138  | 3,358                | ... 10,702                                      |   |   |
| 1907  | 123                 | ... 160  | 5,362                | ... 11,410                                      |   |   |

These figures make it very clear that not long after the Act of 1903 came into operation—on January 1, 1904—raising the maximum speed-limit from twelve miles an hour to twenty, the casualties caused by motor traffic increased rapidly. Injuries caused by non-motor traffic have also increased greatly in the last five years.

NOVEMBER has opened with the same fine and brilliant weather which characterised October, except that, in keeping with the season, there has been a decided fall of temperature, although the thermometer both by day and night remains several degrees above the average. The mean maximum temperature in London for October was about 6° above the average, and at Greenwich there were six days with the sheltered thermometer above 70°, and twenty-two days with the reading above 60°, whilst on October 3 and 29 the temperature exceeded all previous records, on the corresponding days, by 3°. The duration of bright sunshine was generally in excess of the average over the country, and in London the sun shone for ninety-eight hours, which is thirty hours more than the average. The aggregate rainfall for the month varied considerably in different parts of the kingdom, but there was generally a deficiency; the early part of the month was mostly very dry, but fairly heavy rains were general towards the close of October. In London there was a deficiency of rain amounting to 0.8 inch, the measurement being 1.9 inches.

THE Allahabad *Pioneer* published recently a further account of the explorations of Dr. M. A. Stein, written from Khotan in July last. In September, 1907, he commenced his long journey to the Tarim Basin for his second winter archaeological campaign. He reached Karashahr, on the border of this region, in December, and at Korla made a fresh investigation of a group of Buddhist shrines, which had already been examined by Prof. Grünwedel. Many fine painted panels and reliefs were unearthed here. The country, once irrigated from the Karakash River, must in former times have supported a large and thriving population, and even now, if the channels were restored, these settlements might be re-established. About Christmas the cold of the valley drove the party to the sunnier hill country. After returning to Korla he marched from the Inchike or Shahyar River along a previously unexplored route to the Kuchar oasis, where the ruins had lately been carefully explored by successive parties of Japanese, German, and Russian archaeologists. So, after a hazardous desert march, he was glad to re-visit his old hunting-ground at Kara-dong. March and April were spent in examining the desert belt adjoining the oasis from Damoko to Khotan, and from a collection of unsavoury

middens he recovered a great mass of documents, mainly Indian, Chinese, and Tibetan, none of which, apparently, is later than the eighth or ninth century A.D. At the beginning of May Dr. Stein reached Aksu, after suffering severely from heat and dust-storms. Here he arranged for the continuation of the survey of the outer Tien-shan range as far westward as the passes above Kashgar. After some further exploration the traveller was forced to return to Khotan, where, when this letter was dispatched, he was engaged in packing up his large collections, many of them consisting of fragile documents, which need much care, preparatory to sending them by the long and difficult route across the Himalaya to India.

We have received a letter from Mr. C. V. Raman, of the Science Association Laboratory, Calcutta, directing attention to a method of illumination employed in microscopy by Mr. G. Dubern in 1888, and described in *Indian Engineering* for April of that year. Mr. Raman claims that the apparatus renders visible ultra-microscopic particles, and that Siedentopf's and Szegmány's method was thus anticipated. The apparatus consisted of a polished glass plate, one end of which was cut off, forming an angle of 54° 35' with the base; through this slant end a powerful beam of light was projected. We have examined the description of the apparatus in *Indian Engineering*, and consider that the method (not altogether novel even at that date) was one of dark-ground illumination, any form of which tends to render ultra-microscopic particles visible, but that it cannot be considered in any way as anticipating the modern ultra-microscopic apparatus.

In addition to a memoir, with portrait, of Prof. W. Lilljeborg, the October number of *Naturen* contains an interesting account of the results of Mr. Luther Burbank's experiments in developing and hybridising various fruits, especially plums. Illustrations are given of the wild and cultivated forms of the French plum, of the "plumcot" (plum crossed with apricot), and of the hybrid blackberry and raspberry.

ACCORDING to *Museum News* for October, there has been installed in the Brooklyn Museum a case showing the home of the guacharo, or oil-bird, of Trinidad. The scene represents a cave tenanted by hundreds of these birds, with their nests, eggs, and young. The rainy season is the time of nesting, and the cave is consequently represented as dripping with water and the nests saturated. The cave is lighted by electricity, which can be switched on or off at pleasure. A group of five sea-lions forms another addition to the exhibited series. In the matter of realistic groups of this nature the Brooklyn and other American museums are leaving our own Natural History Museum far behind.

WE have to acknowledge the receipt of copies of articles 12-14 of the twenty-third volume of the Journal of the College of Science, Imperial University of Tokyo, the contents of all three of which are mainly of interest to specialists. Japanese serpularian zoophytes of the group Primnoidea form the subject of article 12, by Mr. K. Kinoshita, and are illustrated by several excellent plates in black and white. In No. 13 Mr. S. Tanaka treats of some rare Japanese fishes, with descriptions of one new genus, one subgenus, and six species, while in article 14 Prof. Einar Lönnberg, of Stockholm, contributes a list of the bird-fauna of the island of Saghalin, based on collections at Tokyo, in which three new subspecies are named. The new genus (*Gymnosimenchelys*) in Mr.

Tanaka's paper is represented by a small eel-shaped fish allied to Simenchelys, but scaleless.

IN view of the attention that is now being concentrated on the house-fly as a disseminator of disease, the appearance in the October issue of the *Quarterly Journal of Microscopical Science* of the second part of Mr. C. G. Hewitt's paper on the structure, development, and habits of the species is extremely opportune. In this portion the author deals with the breeding-habits and the anatomy and development of the grubs. After full reference to the work of previous naturalists, it is concluded that horse-manure is the favourite breeding-place, although decaying organic matter of almost any kind may form the *nidus* for the eggs. The rate of development depends entirely on temperature, and it is important to notice in this connection that the substance in which the eggs are laid is generally in a state of fermentation. The shortest time for development—from laying to the appearance of the perfect fly—is eight days, but the period may be extended over several weeks. There are three grub-stages. From June to October is the chief breeding-season, although under favourable conditions flies may be fertile all the year. The flies become sexually mature in from ten to fourteen days after their first appearance in the world, and they may begin to lay within a fortnight. Each fly may lay six batches of ova, each containing from 120 to 130 eggs. The "bionomics" of the species will be discussed in the third and final part of the paper.

THE spoliation of the Falls of Niagara, on account of the abstraction of the water for electrical and other works, forms the subject of an exceedingly interesting article in the October number of the *Popular Science Monthly*, by Dr. J. W. Spencer, who has devoted much attention to the study of rivers generally. After referring in more or less detail to the various power-stations connected with Niagara, the author notes the very great lowering of the water-level above the falls as the result of this tapping. As an example of the enormous amount of water taken by these works, it is stated that when in June last a single company temporarily stopped its take of 8000 cubic feet per second, the water in the basin rose no less than 6 inches, and at the edge of the American falls 1·2 inches. "The preservation of the falls," continues Dr. Spencer, "is now a question of inches. Under the conditions as set forth [*i.e.* as regards further tapping], the whole of the Horseshoe Falls will have shrunken from a crest-line of 2950 feet to 1600 feet, and their diameter will have been reduced from 1200 to 800 feet. They will then be entirely within Canadian territory, as the boundary line will become uncovered, leaving a narrow strip of rock between Goat Island and the great cataract. If the full franchise be used, the American Falls, which are 1000 feet across, will have their southern half drained, and will be further broken up into narrow sheets or strings of water." The preservation of the falls, it is added, now depends entirely upon the Governments of Washington and Ottawa; it is sincerely to be hoped that they will so regulate matters as to retain the world-renowned falls for all time. In a second article, by Mr. R. H. Arnot, the industries connected with the falls are described at length.

A THIRD part of the current botanical volume of the *Philippine Journal of Science* (July) contains a list of plants collected near Lake Lanao Mindaneo by Mrs. Clemens, and identified by Mr. Merrill; also a series of identifications of Philippine plants, in which Mr. R. A. Rolfe is associated with Mr. Merrill. A *Ranunculus* closely allied to the

Australian *Ranunculus lappaceus*, the genera *Hoppea* and *Hemiphragma* furnishing an Indian element, and the genus *Spiraeopsis* known only from the Celebes, are geographically interesting. Mr. F. W. Foxworthy records the identification of "lumbayao" timber as the product of *Tarrietia javanica*. The allied *Tarrietia sylvatica* furnishes the timber "duñgon," that is better known, but here reported inferior.

THE discovery in Siam of a new genus of the unique order *Rafflesiales* is recorded by Dr. C. C. Hosseus in Engler's *Botanische Jahrbücher* (vol. xli., part ii.). The plants of this order are parasitic herbs, consisting of a vegetative structure reduced to a network of cellular threads ramifying in a host plant, and of flowers subtended by a few scale leaves. The new genus, *Richtofenia*, falls into the tribe *Rafflesieæ*, together with the genera *Rafflesia*, *Sapria*, and *Brugmansia*. It is similar to *Rafflesia* in the possession of a plurilocular ovary, but agrees with *Sapria* as regards its bilocular anthers. It thus forms a connecting link between the two genera. Its habitat, too, lies between the Malayan home of *Rafflesia* and the Himalayan locality of *Sapria*.

IT is fully recognised that considerable risks attach to the formation of pure forests owing to the liability of destruction by the rapid spread of insect or fungus pests. American investigators have provided another reason in favour of mixed plantations in so far as they attribute weight to soil deterioration by the excretion of toxic material from the roots. The editorial note in the *Indian Forester* (September) touches upon these points, and further arguments applying to conditions in India in favour of intermixing trees of less value are adduced by Mr. P. Lushington. Firstly, there is the fuel value to be considered, but, in addition, it is pleaded that "worthless" species provide cover for the ground, or may serve to draw up the high-class trees, or in the case of evergreens help materially to check forest fires.

THE Oxford list of British plants is one of three such publications recently issued, the other two being a list compiled by the botanical authorities at the Natural History Museum, South Kensington, and the tenth edition of the London catalogue. The South Kensington list is the most restricted, as the critical forms of *Hieracium*, *Rubus*, *Euphrasia*, and *Salix* are omitted, all varieties, also extinct and various introduced plants. A special feature is the reference to the original determination of each species. The Oxford list is, on the other hand, the most comprehensive, registering varieties and aliens of all kinds, or foreigners as some might be called. The London catalogue approximates to the Oxford list, differing chiefly in a greater discrimination of aliens. There is, however, one notable point of distinction in the latter, as Mr. Druce refuses to accept the list of special generic names passed by the Vienna Congress as worthy of retention. While respecting his opinion, it seems a mistake not to abide by the decision of the congress. To coordinate the species in the three publications may well be left to the ardent systematist. Doubtless all three will find supporters, besides being used for comparison. Certainly the Clarendon Press could have found no botanist better versed in the intricacies of the British flora than the author they have selected.

THE *Journal of the Meteorological Society of Japan* for July contains a discussion, by T. Ogawa, of the climate of Fusun (south-east of Corea) from observations since 1904. The seasonal means of air temperature are:—

spring,  $53^{\circ}2$ ; summer,  $73^{\circ}0$ ; autumn,  $60^{\circ}8$ ; winter,  $38^{\circ}7$ . The extremes observed were  $13^{\circ}5$  and  $92^{\circ}5$ ; the periods of greatest cold and heat coincide approximately with our own. The annual rainfall is about  $56\frac{1}{2}$  inches, the average number of rain-days being 109. There is a fairly large rainfall in every month from January to September, especially in July, but only a slight fall during the rest of the year. M. Ishida contributes an article on the causes of the very heavy winter rainfall in the western part of Honshu (facing the Sea of Japan). Abstracts of these articles are given in English.

THE programme of the Institute of Archaeology and Anthropology in connection with the University of Liverpool is sufficiently ambitious; but with working members like Profs. Frazer, Newberry, and Myres it seems likely to achieve success. The Institute, so far as British archaeology is concerned, proposes to conduct an archaeological and historical survey of North Wales; and in the course of excavations here it is hoped to train a body of students who will be available for similar work abroad. Besides this, schemes are on hand for excavations in Egypt and British Honduras. As a record of its work, the Institute has commenced the publication of a series of "Annals of Archaeology and Anthropology," under the editorship of Prof. Myres, of which the opening double number for September has lately appeared. It is chiefly devoted to Egyptian and Hittite archaeology. In the latter field the most interesting contribution is the account by Prof. Garstang of Dr. Winckler's excavations at Boghazkœui, in Cappadocia, where the discovery of a copy of the treaty between the Hittite monarch and Rameses the Great fixes for the first time a definite date on which the chronology of the Hittite empire can be safely based.

DR. G. A. AUDEN, medical superintendent under the Educational Committee of Birmingham, has, with the assistance of Miss Byron, done a useful service to archaeology by issuing, side by side with the Danish and German editions, an English version of the new guide to the prehistoric collections in the Danish National Museum at Copenhagen, which has been compiled by Dr. Sophus Müller. This is more than a catalogue of the important series of specimens discovered in Danish soil, because it will serve as a useful introduction to the study of a branch of archaeology which has hitherto received too little attention in this country. The manual is divided into periods: the earlier and later Stone and Bronze ages; the pre-Roman and Roman Iron ages; the post-Roman Iron age; and, finally, the Viking period. It is illustrated throughout with excellent engravings. As a concise account of north European prehistoric antiquities it may be usefully consulted side by side with the admirable guides to the collections in the British Museum for which we are indebted to Mr. C. H. Read.

THE bright lines or streaks seen when moonlight is reflected from water that is covered with regular ripples, or the light of a lamp is reflected from a corrugated or regularly polished surface, have often formed subjects for questions in the few examinations in which geometrical optics figures in this country. In a paper in the Transactions of the American Mathematical Society, ix., 3, Prof. W. H. Roever discusses the general mathematical theory of "brilliant points" on curves and surfaces, and his paper is illustrated by photographs of the brilliant lines on the surface of a circular saw which had been polished in rotation.

THE Physical Review for September contains an article on the diffusion of salts in aqueous solutions, by Mr. R.

Haskell, of the Massachusetts Institute of Technology, in which the theory of diffusion is brought into line with the dissociation theory of solutions. The dissolved salt is taken as partially dissociated, and the theory is worked out on the supposition that the diffusion of each molecule is proportional to the rate of change per cm. of the concentration of that molecule, whether dissociated or not, multiplied by a constant called the diffusion constant, which may have different values for a dissociated and for a non-dissociated molecule. The measurements were made by determining the electrical resistance between pairs of platinum electrodes placed at different heights in a vertical cylinder filled initially with pure water, with a layer of concentrated solution at the bottom the strength of which was maintained from an external reservoir. The author finds the theory confirmed by his observations on thallium sulphate and barium nitrate, and in both these cases the diffusion constant for dissociated is double that for non-dissociated molecules.

WE have received from Knowledge a specimen of the Knowledge calculator, which has been designed by Major B. Baden-Powell, and is put on the market at the low price of 3s. 6d., or 3s. 8d. by post from the Knowledge Office, 27 Chancery Lane. The calculator is in reality a circular slide-rule made in card. As the diameter of the circle is almost exactly 6·5 inches, it is equivalent in openness of scale to a straight rule, divided from 1 to 10 only,  $20\frac{1}{2}$  inches long, or to a straight rule divided from 1 to 100 of twice that length. A considerable number of gauge points or conversion factors are marked round on the inner card, and directions are given at the back for using the instrument. The advantage of openness of scale of the circular form has to be set against certain other advantages of rules of the Gravet type which, in the writer's opinion, are the more valuable; still, whether one or other form is to be preferred must, of course, be determined by each user for himself. It does not seem probable that any other form of circular rule made of card could be designed so as to be more effective and inexpensive than this.

THE existence of a perchromic acid has been known for the last sixty years, and the blue coloration resulting from the action of sulphuric acid and hydrogen peroxide upon chromates has taken its place as a useful test for chromates. In spite of many researches, however, the exact constitution of these perchromates has remained doubtful. In the August number of the *Berichte der naturforschenden Gesellschaft zu Freiburg i. Br.* there is a paper by E. H. Riesenfeld in which the whole of the work on this subject is reviewed, and further experiments described settling the composition of these compounds. Four definite series of perchromates are described:— $H_3CrO_8$ , giving red salts with sodium, potassium, and ammonium;  $H_3CrO_7$ , giving blue perchromates;  $KH_2CrO_7$ , and  $(NH_4)H_2CrO_7$ ; the pyridine salt of the perchromic acid,  $HCrO_5$ ; and the ammonia addition product of perchromic anhydride,  $CrO_4$ . All these compounds are analogous, and are convertible the one into the other under suitable conditions.

MESSRS. WILLIAMS AND NORGATE has published vol. viii. of the new series of the Proceedings of the Aristotelian Society. The volume contains Mr. Haldane's presidential address on the methods of modern logic and the conception of infinity, the papers read before the society during the session 1907-8, an abstract of the minutes of the proceedings of the society for the session, the rules, and a list of officers and members of the society. The price of the volume is 10s. 6d. net.

WE have received from the Pulsometer Engineering Co., Ltd., a copy of their latest catalogue of "Geryk" air-pumps. The list also contains a full description of the Fleuss patent pump for desiccating or for steam condensers, which has been awarded a diploma for a gold medal in connection with the Franco-British Exhibition. These pumps are specially designed for desiccating, chemical work, distillation, and so on, their special feature being that they will pump condensable vapours of alcohol, ether, &c., to a high vacuum as readily as ordinary dry air.

DR. ROBERT A. LYSTER'S "School Hygiene," published by Mr. W. B. Clive, has reached a second edition. A chapter dealing with the organisation of medical inspection in schools has been added to the new edition.

MESSRS. GEORGE BELL AND SONS have published an eighth edition of Dr. Percy Groom's "Elementary Botany." Two new chapters have been added, dealing respectively with "Form and Function" and "Soil and Distribution of British Plants," and some additional notes have been interspersed in the text.

A FOURTH edition of Mr. J. M. Lawson's "Text-book of Botany" has been published by Mr. W. B. Clive. The book has been enlarged by the addition of new matter, and several changes have been made. The sections dealing with the stellar theory have been re-written, and the life-history of *Hæmatococcus*, and a chapter on ecology and plant distribution, have been introduced.

THE first part of a work on the "Geologie der Steinkohlenlager," by Dr. Dannenberg, has been published by the firm of Gebrüder Bornträger, Berlin. The second volume will probably appear at the end of next year, and we propose to defer our notice of the work until that part reaches us.

#### OUR ASTRONOMICAL COLUMN.

THE SPECTRUM OF COMET MOREHOUSE, 1908c.—In a communication to the *Comptes rendus* (No. 16, October 19, p. 666) MM. A. de la Baume Pluvinel and F. Baldet give an account of the spectrum of comet 1908c as photographed by them at the Juvisy Observatory on October 4, 5, and 7.

The instrument used was that previously employed for the photographing of the spectra of comets 1902b and 1907d, an objective-prism camera of 0.08 m. aperture and 0.30 m. focal length, the angle of the prism being  $20^{\circ} 18'$ ; the results are, therefore, comparable. Wratten's "pinacyanol" plates were used.

On each plate there appear seven monochromatic images of the comet, of which the approximate wave-lengths are 465–458, 448, 421, 397, 388–385, 376, and 367. Of these, the first image was faint and without a tail, the second more intense, with tail, the third the most intense of all, with a very extensive tail, and the fourth was but a little less intense than the third. The image at  $\lambda$  388–385 was of an extended nebulous character degrading towards the violet, the tail being confused. Evidence of change appears at  $\lambda$  376, for whilst a tail accompanies the feeble image obtained on October 5, there is none accompanying the more intense image of October 7; the image at  $\lambda$  367 is extremely faint.

The spectrum displays the absence of the hydrocarbons, which were a feature of that of Daniel's comet, whilst the complete system of the cyanogen spectrum—so far as possible under the observing conditions—is represented; usually the band at  $\lambda$  388 only is represented in cometary spectra. The origin of the radiation at  $\lambda$  397 is unknown. The monochromatic images of the tail extend to some 34' from the nucleus, thus being relatively long as compared with those of Daniel's comet, despite the fact that the nucleus of the latter was more intense.

SOLAR VORTICES AND THEIR MAGNETIC EFFECTS.—An account of an interesting research by Prof. Hale on solar vortices and their magnetic effects appeared recently in this Journal (August 20, pp. 368, 369). Prof. Zeeman also contributed an account expressing his opinion as to the interpretation of the results obtained. Prof. Zeeman has now sent us an advance proof of a communication he made to the meeting of the physical section of the eightieth gathering of the Deutscher Naturforscher und Ärzte at Cologne on September 23, which contains further important results communicated by Prof. Hale.

It will be remembered that Hale examined the spectrum of a sun-spot situated near the middle of the solar disc, using a Fresnel rhomb and Nicol prism mounted in front of the slit of the spectroscope, and obtained results which indicated the Zeeman effect. When a sun-spot is near the middle of the solar disc, the direction of the light from the spot is along lines of force which are at right angles to the plane of the vortices in which the electric currents are encircling. The changes in the lines in the spectrum of the spot are due, therefore, to the "longitudinal effect," as termed by Voigt, and this is what Prof. Hale observed.

If now the sun-spot be on the limb of the sun, the light from the spot will be observed in a direction at right angles to the lines of force, or in the plane of the circulating electric currents. The lines in the spectrum should then be plane polarised, and show the "transversal effect." The important new fact which Prof. Zeeman gives in his paper is that this observation has now been made by Prof. Hale, who has reported as follows:—"Vortices rotating opposite directions show opposite polarities; spot lines near limb plane polarised."

The observations of both these longitudinal and transversal effects indicate very conclusively that sun-spots are very intense magnetic fields, and this important discovery will certainly stimulate work on many allied investigations.

THE WAVE-LENGTH OF THE H $\delta$  LINE.—In No. 2, vol. xxviii., of the *Astrophysical Journal* (p. 162, September), Mr. Evershed gives the results he has obtained from measurements of the wave-length of the H $\delta$  and H $\epsilon$  lines in the solar spectrum.

Previous observers have called in question Rowland's value (4102.00) for the H $\delta$  line, but, according to Jewell, the position given in the "Preliminary Table of Wave-lengths" is most probably correct.

On photographs taken with a specially designed grating spectrograph, during 1907, Mr. Evershed measured the fine absorption line superposed on the bright emission line of the chromosphere, a spectrum suitable for this purpose being obtained by placing the slit of the spectrograph slightly within the limb of the sun's image. The results obtained were not numerous or accordant enough to give a definitive value for H $\delta$ , but they do show conclusively, in Mr. Evershed's opinion, that the line does not differ appreciably from its theoretical position derived from Balmer's formula for the series. The recently determined mean value is 4101.900, the theoretical value being 4101.893. From measurements of the bright H $\epsilon$  line, Mr. Evershed obtains the mean value  $\lambda$  3970.212, whilst the theoretical value is 3970.225.

METEORIC IRON AND ARTIFICIAL STEEL.—From the council of the Iron and Steel Institute we have received a reprint (No. 3, 1907) from the Journal which contains a paper by Prof. Fredk. Berwerth, of Vienna, in which the author shows that there is a close connection between meteoric iron and steelworks' steel. Many of the characteristics of meteoric irons can be reproduced artificially, and Profs. Arnold and McWilliam have even been able to produce a steel, with 0.39 per cent. of carbon, on which the Widmannstätten figures can be formed.

Proceeding, Prof. Berwerth gives a list of fifteen constituents of meteoric irons and their compositions, and also directs attention to the comprehensive character of the collection of meteorites to be found in the Imperial Natural History Museum at Vienna. This collection includes falls from 615 different localities, weighing altogether nearly 3½ tons. Of these, 232 are iron, 28 iron or stone, and 355 stones without iron.